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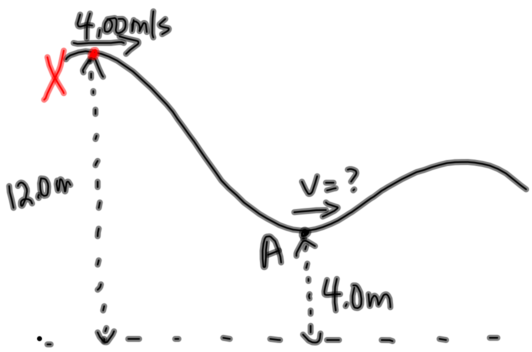

$$E_{total} = E'_{total}$$

(X) (A)

$$E_{g_X} + E_{k_X} = E_{g_A} + E_{k_A}$$

$$\cancel{m}gh_X + \frac{1}{2}\cancel{m}v_X^2 = \cancel{m}gh_A + \frac{1}{2}\cancel{m}v_A^2$$

$$(9.81\,m/s^2)(12.0\,m) + \frac{1}{2}\left(4.00\,\frac{m}{s}\right)^2 = \left(9.81\,\frac{m}{s^2}\right)(4.0\,m) + \frac{1}{2}v_A^2$$

Conservation of Energy (Kinetic + Elastic Potential Energy)

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$m = 0.25 kg$

$k = 155 N/m$

$x = -0.060 m$

$v = ??$

Using the Law of Conservation of Mech. Energy

$$E_{total} = E'_{total}$$

(cart) (spring is fully compressed)

$$E_K + \cancel{E_e} = \cancel{E'_K} + E'_e$$

$\quad 0 \quad\quad 0$

$$\cancel{\tfrac{1}{2}} mv^2 = \cancel{\tfrac{1}{2}} kx^2$$

$$mv^2 = kx^2$$

$$v^2 = \frac{kx^2}{m}$$

$$v^2 = \frac{(155 N/m)(-0.060 m)^2}{0.25 kg}$$

$$v \doteq 1.5 m/s$$

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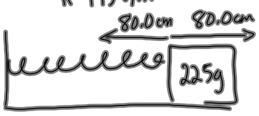
$k = 145\,N/m$



* E_e is a maximum when the displacement of the mass from the equilibrium position is at maximum $\Rightarrow E_K = 0$

* E_K is a maximum when the mass passes through the equilibrium position $\Rightarrow E_e = 0$

a) $v_{max} = ?$ (at the equilibrium position)

b) $x = ?$, when $v = \frac{1}{2} v_{max}$

a) $E_{total} = E'_{total}$

(fully stretched) (at equilibrium)

$E_e + E_K = E'_e + E'_K$ ($E_K = 0$, $E'_e = 0$)

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$kx^2 = mv^2$

$v^2 = \frac{kx^2}{m}$

$v^2 = \frac{(145\frac{N}{m})(0.800m)^2}{0.225kg}$

$v = \pm 20.3\,m/s$

the mass could be moving in either direction → + stretch | − compression

b) $x = ?$ when $v = \frac{20.3\,m/s}{2} = 10.15\frac{m}{s}$

$E_{total} = E'_{total}$

(fully stretched) (partially stretched)

$E_e + E_K = E'_e + E'_K$ ($E_K = 0$)

$\frac{1}{2}kx_1^2 = \frac{1}{2}kx_2^2 + \frac{1}{2}mv^2$

$\frac{1}{2}(145\frac{N}{m})(0.800m)^2 = \frac{1}{2}(145\frac{N}{m})x_2^2 + \frac{1}{2}(0.225kg)(10.15\,m/s)^2$

$46.4J = \frac{1}{2}(145\frac{N}{m})x_2^2 + 11.6J$

(total) (PE) (KE)

$34.8J = \frac{1}{2}(145\frac{N}{m})x_2^2$

$\frac{2(34.8J)}{145\frac{N}{m}} = x_2^2$

$x_2 = 0.693\,m$ or $69.3\,cm$

TODO

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Note: 9 b) 3.4 m/s (answer in book is WRONG!)